

## **ENVIRONMENTAL PROTECTION COMMISSION[567]**

### **Notice of Intended Action**

Pursuant to the authority of Iowa Code section 455B.105(3) and 455B.187, the Environmental Protection Commission hereby gives Notice of Intended Action to amend Chapter 38, “Private Water Well Construction Permits,” Chapter 39, “Requirements for Properly Plugging Abandoned Wells,” Chapter 49, “Non Public Water Supply Wells,” and Chapter 82, “Well Contractor Certification,” and to adopt new Chapter 48, “Ground Heat Exchanger (GHEX) Loop Borehole Systems,” Iowa Administrative Code.

The purpose of this rule making is to rescind current GHEX language from Chapter 49 and to adopt a new chapter of GHEX loop borehole rules that standardize the minimum construction requirements of this type of well structure and to create additional protections to Iowa’s groundwater. The new rules will closely compare to nationwide standards that are accepted by contractor trade groups and will be more relevant to the actual geological settings found in Iowa. In addition, a revised table for “lateral separation distances” has been proposed for Chapter 49 to clarify areas that create questions the placement of water supply wells.

Public Hearings will be held late this summer. Questions and comments should be directed to Russell Tell, Iowa Department of Natural Resources, Water Supply Bureau, 502 East 9<sup>th</sup> Street, Des Moines, Iowa, 50319, fax (515) 725.0462, or by E-mail to [Russell.tell@dnr.iowa.gov](mailto:Russell.tell@dnr.iowa.gov).

The proposed rulemaking is intended to implement Iowa Code subsections Iowa Code sections 455B.172, 455B.173 455B.187, 445B.190 and 455B.191A .

The following amendments are proposed.

**ITEM 1.** Amend rule **567--38.1(455B)**, definition of “Construction,” as follows:

“*Construction*” means the physical act or process of making a water well or GHEX loop borehole, including, but not limited to, siting, excavation, construction and installation of equipment and materials necessary to maintain and operate the well or a GHEX loop borehole system.

**ITEM 2.** Adopt the following new definition in **567--38.1(455B)**:

“*GHEX loop borehole*” means ground heat exchange loop borehole(s) or ground-coupled, closed-loop, heat exchange borehole(s) or geothermal boreholes, or heat pump loop borehole(s) or any excavation which is 20 feet or greater in depth that is drilled, directionally drilled, cored, driven, dug, bored, augered, jetted, washed or is otherwise constructed into which a closed loop heat exchanger is installed for use as part of a ground heat exchange system.

**ITEM 3.** Amend rule **567--38.2(455B)** as follows:

**567—38.2(455B) Forms.** The following application form is currently in use: Application for Private Water Well Construction Permit. ~~12/98~~ 542-0988

**ITEM 4.** Amend subrule **38.3(1)** as follows:

**38.3(1) When permit required.** A landowner or landowner’s agent shall not drill or construct a new private water well or construct GHEX loop boreholes without first obtaining a well construction permit issued by the department or the ~~county board of supervisors~~ local

county permitting authority ~~by a county board of supervisors or the board's designee~~ authorized to issue permits pursuant to this chapter. Examples of private water wells requiring well construction permits include, but are not limited to: domestic wells, livestock wells, irrigation wells, recreational-use wells, monitoring wells, heat pump supply wells or GHEX loop boreholes, industrial wells, and dewatering wells, except that dewatering wells shall be exempt from the construction standards of 567—Chapter 49 (nonpublic water wells).

**ITEM 5.** Amend rule **567--38.4(455B)** as follows:

**567—38.4(455B) Form of application.** Application shall be made on forms supplied by the department. However, counties that have active delegation of authority to issue new private well construction permits pursuant to rule 38.15(455B) may develop and use their own application forms subject to the approval of the department. Each application shall list all wells, including nonplugged abandoned wells, on the applicant's property contiguous to the well site described in the application and shall describe the location of each well site. The location shall be given in the form of a legal land description (section, township and range) to the nearest quarter of a quarter of a quarter of a section, or as a latitude and longitude in degrees to four decimal accuracy. The list of wells to be registered shall include but is not limited to abandoned wells, inactive wells, agricultural drainage wells, irrigation wells, domestic wells, ~~and livestock wells~~ and existing GHEX loop boreholes. GHEX loop borehole well applications shall also include a pre-drilling water well survey as noted in 567 IAC 48.7(1) and 48.7(2).

**ITEM 6.** Amend rule **567--38.10(455B)** as follows:

**567—38.10(455B) Expiration of a permit.** A private well construction permit shall expire one

calendar year from the date of issuance. If construction of the proposed well is not started prior to the expiration date, a new application plus a new nonrefundable fee must be filed with the department or the ~~county board of supervisors~~ local county permitting authority pursuant to rule 567--38.15(455B).

**ITEM 7.** Amend rule **567--38.12(455B)** as follows:

**567—38.12(455B) Denial of a permit.** The department or contracting local county permitting authority may deny a private well construction permit if granting the permit would lead to the violation of state law, could result in groundwater contamination, would lead to withdrawal from a protected source, or the well could threaten public health or the environment. Examples of wells that could threaten public health or the environment and, therefore, may be denied construction permits include, but are not limited to: in situ mining wells, wells which may result in a negative impact on an identified point source of groundwater contamination and cause leachate plume to spread or migrate, underground injection wells except as provided in 567—subrule 50.6(4) and 567—62.9(455B) and GHEX loop boreholes located in or nearby contaminated sites or where the borehole construction may cause contamination of groundwater or aquifers.

**ITEM 8.** Amend rule **567--39.3(455B)** by adopting the following new definition:

*“GHEX loop borehole”* means ground heat exchange loop borehole(s) or ground-coupled, closed-loop, heat exchange borehole(s) or geothermal boreholes, or heat pump loop borehole(s) or any excavation which is 20 feet or greater in depth that is drilled, directionally drilled, cored, driven, dug, bored, augered, jetted, washed or is otherwise constructed into which

a closed loop heat exchanger is installed for use as part of a ground heat exchange system.

**ITEM 9.** Amend rule **567—39.8(455B)** by adopting the following new subrule:

**39.8(6)** GHEX loop boreholes. Any GHEX loop borehole that can not be used as a heat exchanger and which does not contain any heat exchanger piping shall be plugged using the appropriate 39.8(4) “Class 2” plugging requirements that generally describes the actual geology encountered during drilling operations. All GHEX loop boreholes that contain heat exchanger piping shall be plugged following the requirements for the plugging of GHEX loop boreholes found in 567—Iowa Administrative Code Chapter 48.10(1), “Abandonment and plugging of GHEX boreholes.”

**ITEM 10.** Amend rule **567--49.2(455B)** by adopting the following new definition:

*“GHEX loop borehole”* means ground heat exchange loop borehole(s) or ground-coupled, closed-loop, heat exchange borehole(s) or geothermal boreholes, or heat pump loop borehole(s) or any excavation which is 20 feet or greater in depth that is drilled, directionally drilled, cored, driven, dug, bored, augered, jetted, washed or is otherwise constructed into which a closed loop heat exchanger is installed for use as part of a ground heat exchange system.

**ITEM 11.** Amend rule **567--49.3(455B)** as follows:

**567—49.3(455B) Applicability.** The provisions contained herein apply to all nonpublic water supply wells constructed for the purpose of domestic, livestock, irrigation, recreation, and commercial or industrial use. They shall also apply to existing water wells undergoing reconstruction. GHEX loop borehole systems are not covered by these provisions but are

regulated under 567 IAC Chapter 48.

**ITEM 12.** Amend rule **567--49.5(455B)** as follows:

**567—49.5(455B) Variances.** Variances to these rules may be granted by the administrative authority if sufficient information is provided to substantiate equal protection and the need for such action. Variance requests and reasoning shall be in writing. Variance approvals or rejections shall also be in writing. Where permitting authority has not been delegated to the county, the department will review and grant or deny any variance requests within that jurisdiction. If a variance is granted, all conditions required as part of the variance shall be noted in the “variance” and “special conditions” areas of the private well construction permit issued on the department’s Private Well Tracking System (PWTS.)

**ITEM 13.** Rescind subrule **567--49.6(1)(455B)** Table 49.6(1) Minimum Lateral Distances

**ITEM 14.** Adopt rule new subrule **567--49.6(1)(455B)** table 49.6(1) Minimum Lateral Distances

**Table 49.6(1) Minimum Lateral Distances**

	Minimum Lateral Distance (feet)	
	Shallow Well <sup>1</sup>	Deep Well <sup>2</sup>
Public water supply well	400	200
Sources of Contamination		
Formed manure storage structure, confinement building, feedlot solids settling facility, open feedlot	200	100

	All Wells
Earthen manure storage basin, runoff control basins and anaerobic lagoons (see <a href="#">subrule 49.6(2)</a> below)	1000
Domestic wastewater lagoon	400
Industrial wastewater stabilization basin, lagoon or pond	200
Preparation or storage area for spray materials, commercial fertilizers or chemicals that may result in groundwater contamination	100
Drainage wells	1000
Private water wells that conform to this chapter	10
Private water wells that do not conform to this chapter	100
Soil absorption field, any sewage treatment system with an open discharge, pit privy or septic tank discharge line (not conforming to <a href="#">567—Chapter 69</a> )	100
Septic tank, concrete vault privy, sewer of tightly joined tile or equivalent material, sewer-connected foundation drain, or sewers under pressure	50
Sewer of cast iron with leaded or mechanical joints, sewer of plastic pipe with glued or compression joints, independent clear water drains, cisterns, well pits, or pump house floor drains	10
Hydrants	10
Storage tanks used for liquid hydrocarbons, fuels, biofuels, or oil storage	100
Above grade liquefied petroleum gas (LPG) storage tanks	25
Below grade liquefied petroleum gas (LPG) storage tanks	50
Frost pit	10
Frost-free water-tight vault constructed of solid PVC pipe with PVC caps and pitless adaptor designed to hold a 1-2 gallon pressure tank for VFD <sup>3</sup> or CP <sup>4</sup> pumping systems and connect to a well system	5
Property lines (unless a mutual easement is signed and recorded by both parties)	4

<sup>1</sup> As defined in 567—Chapter 49.2 “shallow well”  
<sup>2</sup> As defined in 567—Chapter 49.2 “deep well”  
<sup>3</sup> Means variable frequency drive pump systems,  
<sup>4</sup> Means constant pressure pump systems

**ITEM 14.** Amend rule **567--49.29(455B)** as follows:

**567—49.29(455B) Closed circuit vertical heat exchangers or GHEX Loop borehole systems.**

~~These provisions apply to closed circuit vertical heat exchanger construction. Provisions that~~  
apply to GHEX loop boreholes and closed loop heat exchangers used as part of a heating and/or  
cooling system are found in 567 IAC Chapter 48.

~~49.29(1) Piping used must be 160 psi pressure-rated high density polyethylene or polybutylene.~~

~~49.29(2) Connection to piping must use socket fusion or butt fusion joining methods.~~

~~49.29(3) Piping must be pressure tested with air or potable water for 15 minutes at a pressure of 1.5 times the system operating pressure after installation in the borehole.~~

~~49.29(4) The annular space between the vertical heat exchanger piping and the borehole must be grouted as required in subrule 49.9(3) using an approved grouting method and material. Grout shall be placed at least in the top 40 feet. Any confining layers between aquifers shall be replaced with grout. Grouting must be performed within 24 hours of completion of the borehole.~~

~~49.29(5) Only food grade or USP grade propylene glycol or calcium chloride may be used as heat transfer fluid. Any other materials or additives must be NSF-approved for drinking water applications. A permanent sign must be attached to the heat pump specifying that only approved heat transfer fluids may be used.~~

~~49.29(6) A flow measurement device must be installed on each system.~~

~~49.29(7) Water make up lines to the vertical heat exchanger must be protected with a backflow prevention device.~~

**ITEM 15.** Amend rule **567--82.1(455B)** definitions of “Certified well contractor” and “Well services” as follows:

“*Certified well contractor*” means a well contractor who has successfully passed an examination prescribed by the department to determine the applicant’s qualifications to perform well drilling services, or GHEX loop borehole services, or pump services ~~or both~~.

“*Well services*” means ~~both~~ well drilling services or GHEX borehole drilling services or



~~and~~ pump services or any combination of these services.

**ITEM 16.** Adopt the following new definitions in rule **567--82.1(455B)**:

*“GHEX loop borehole driller”* means a person certified by the department to perform GHEX loop borehole services.

*“GHEX loop borehole services”* means the drilling of GHEX loop boreholes, fusion and installation of loop borehole heat exchanger piping into the borehole, placement of loop borehole filling materials, borehole stabilizing materials, borehole sealing materials and borehole grout, and abandonment and plugging of GHEX loop boreholes and loop borehole heat exchangers.

**ITEM 17.** Amend subrule **82.2(1)** as follows:

**82.2(1) *Certified well contractor requirement.*** All well services shall be performed by a certified well contractor pursuant to this chapter, except that a person may perform well services on the person’s own property without being certified. A certified well contractor shall notify the department or the ~~county~~ local permitting authority prior to performing well drilling services or GHEX loop borehole services for a well at a location that does not have the required construction permits. A certified well contractor shall notify the department prior to drilling a well if the use of the water requires a water use allocation and the owner has not applied for or been issued a water use allocation.

**ITEM 18.** Amend subrule **82.2(2)** as follows:

**82.2(2) *Certified well contractor present.*** A certified well contractor who holds the appropriate certification for the type of wells services being provided shall be present at the well

and water system site or the GHEX borehole site and in direct charge of the well services or GHEX loop borehole services being performed or provided.

**ITEM 19.** Amend subrule **82.3(1)** as follows:

**82.3(1) Classifications.** There shall be three classifications of certified well contractors:

*a.* Certified well contractor.

(1) Well driller.

(2) GHEX borehole driller

~~(2)(3)~~ Pump installer.

*b.* Provisionally certified well contractor.

(1) Well driller.

(2) GHEX borehole driller

~~(2)(3)~~ Pump installer.

*c.* Well plugging contractor.

**ITEM 20.** Amend subrule **82.3(2)** as follows:

**82.3(2) Certified well contractor.** In order to be certified as a certified well contractor, an applicant shall have met the experience requirements, successfully completed the well contractor examination(s) for well drilling services, or GHEX borehole services, or pump services, ~~or~~ ~~both~~ been issued a certificate by the department, and renewed the certification in accordance with rules 82.10(455B) and 82.11(455B).

**ITEM 21.** Amend paragraph **82.3(3)"d"** as follows:

*d.* Successfully complete, with a passing score, the well contractor certification examination for well drilling services, or GHEX loop borehole services, or pump services or ~~both~~ any combination of the exams.

**ITEM 22.** Amend subrule **82.6(1)** as follows:

CLASSIFICATION	<u>REQUIRED EXPERIENCE</u>
Certified Well Contractor (well driller)	Two years' employment and 2000 hours work experience in Class 1 and Class 2 well construction, <u>or a combination of drilling services experiences approved by the department which satisfy this requirement.</u>
<u>Certified Well Contractor (GHEX loop borehole driller)</u>	<u>Two years' employment and 2000 hours work experience in GHEX loop borehole construction or Class 1 and Class 2 well construction, or a combination of drilling services experiences approved by the department which satisfy this requirement</u>
Certified Well Contractor (pump installer)	Two years' employment and 1000 hours work experience in the installation, repair, and maintenance of water systems
Provisionally Certified Well Contractor <u>(all classifications)</u>	One half of the employment and experience required for full certification
Well Plugging Contractor	None

**ITEM 23.** Amend subrule **82.6(2)** as follows:

**82.6(2)** Applicable experience review committee. The department may appoint a peer review committee to help evaluate relevant well services work experience submitted by applicants for certification. The committee should consist of three members recommended by the Iowa Water Well Association, three members of the Iowa Geothermal Association, two members recommended by the Iowa Environmental Health Association, one member recommended by the Iowa Groundwater Association and one member recommended by the Iowa Environmental Council. Committee recommendations shall be considered by the department, which shall make the final determination of eligibility.

**ITEM 24.** Amend subrule **82.7(3)** as follows:

**82.7(3)** *Certification fees.* The certification fee for well drilling contractors and GHEX loop borehole drilling contractors shall be \$75 for each one-half year of a two-year period from the date of issuance to June 30 of the next even-numbered year. The certification fee for pump installation contractors and well plugging contractors shall be \$75 for each one-half year of the first year of certification and \$50 for each additional one-half year period to June 30 of the next even-numbered year.

**ITEM 25.** Amend subrule **82.7(6)** as follows:

**82.7(6)** *Certification renewal fees.* The certification renewal fee for certified well drilling contractors and certified GHEX loop borehole drilling contractors shall be \$300 for the two-year period. The certification renewal fee for pump installers and well plugging contractors shall be \$200 for the two-year period.

**ITEM 26.** Amend the subrule **82.7(8)** as follows:

**82.7(8)** Recertification fee.

a. Contractors who have not earned sufficient CEUs for certification renewal and who wish to recertify within two years after expiration of their certification must retake and pass the written examination(s) and pay a certification fee of \$1000.

b. Contractors who have earned sufficient CEUs but have not completed and submitted the required certification renewal documents and payment, and who wish to recertify within two years after expiration of their certification, must retake and pass the written examinations and pay a certification fee of \$300 plus the actual penalty fee as noted in 82.7(5).

**ITEM 27.** Amend subrule **82.8(1)** as follows:

**82.8(1)** *Type of examination.* There will be four examinations available:

*a.* A general fundamentals examination for well drilling, GHEX loop borehole drilling and pump installation contractors.

*b.* An examination for well drillers.

*c.* An examination for GHEX loop borehole drillers.

~~*e.*~~ *d.* An examination for pump installers.

~~*e.*~~ *e.* An examination for well plugging contractors.

**ITEM 28.** Amend subrule **82.8(2)** as follows:

**82.8(2)** *Required examinations.* Well drilling contractors, GHEX loop borehole drilling contractors, and pump installers must take and pass the general fundamentals examination and at least one of the specialty examinations covering the type(s) of work the individual wants to

perform. Examinations may be taken at the same time and place or at different times. Work shall be limited to the specialty in which proficiency has been demonstrated by passing written examination(s). Well plugging contractors must take and pass the well plugging examination only.

**ITEM 29.** Amend subrule **82.8(3)**, introductory paragraph, as follows:

**82.8(3) Examination application.** A person wishing to take the examination required to become a certified well contractor shall complete the Well Contractor Certification Examination Application supplied by the department, Form 43970. ~~A listing of dates and locations of examinations is available from the department upon request.~~ The application form requires the applicant to indicate educational background, training and past experience in providing well services. The completed application and the application fee shall be sent to the director and addressed to the Iowa Department of Natural Resources, Well Contractor Certification, ~~401 SW 7th Street, Suite M-502~~ East 9<sup>th</sup> Street, Des Moines, Iowa 503019. Application for examination must be received by the department at least ~~60~~ 30 days prior to the date of the examination.

**ITEM 30.** Amend subrule **82.9(2)** as follows:

**82.9(2) Certification by registration without testing.**

a. A well contractor who is engaged in performing pump services on or prior to June 30, 2004, and who registers as a pump installer with the department by June 30, 2004, shall be deemed to have met the certification requirements of this chapter without examination. The experience requirement will apply. Beginning July 1, 2004, a pump installer seeking an initial well contractor certification shall meet the testing requirements for certification established in

this chapter.

b. A well contractor who is currently certified by the department as a well driller and who is engaged in performing GHEX loop borehole services on or prior to January 1, 2015, and who registers as a GHEX loop borehole driller with the department by July 1, 2015, shall be deemed to have met the certification requirements of this chapter without examination. The GHEX work experience requirement does apply. Beginning July 1, 2015, all well contractors seeking well contractor certification as GHEX loop borehole driller shall meet the minimum experience and testing requirements for GHEX loop borehole driller certification established in this chapter.

**ITEM 31.** Amend subrule **82.11(1)** as follows:

**82.11(1) CEU requirements.** Continuing education must be earned during two-year periods between April 1 and March 31 of even-numbered years. A certified well contractor holding well driller certification or GHEX loop borehole driller certification or one or both of the well-driller certifications and pump installer certifications must earn 1.6 units or 16 contact hours during each two year period. A certified well contractor holding only pump installer certification must earn 1.0 units or 10 contact hours during each two-year period. A well plugging contractor may be required to earn 0.2 units or 2 contact hours during each two-year period as determined by the department, provided the well plugging contractor is notified of the requirement at the beginning of the renewal period. Newly certified (previously uncertified) well contractors who are certified after April 1 of even-numbered years will not be required to earn CEUs until the next two-year period.

**ITEM 32.** Amend subrule **82.11(3)** as follows:

**82.11(3) CEU approval.** All activities for which continuing education credit will be granted must be approved by an accredited college or university, an issuing agency, or by the department, and shall be related to well services, relevant aspects of Iowa groundwater law, water well construction, water well maintenance, water well abandonment and plugging practices, GHEX loop borehole services, environmental drilling and groundwater monitoring, well contractor safety (no more than 0.2 CEU per renewal), water system installation and maintenance, state approved water treatment systems, Iowa geology and aquifers, and Iowa hydrogeologic conditions which protect or place at risk the groundwater and water supplies.

**ITEM 33.** Amend subrule **82.12(1)** as follows:

**82.12(1) Submission of records and samples.** Each certified well contractor shall submit complete drilling records to the local county permitting authority and to the department. In addition, and drill cutting samples when required shall be submitted to the ~~Iowa Geological Survey, Department of Natural Resources, Oakdale Campus, University of Iowa, Iowa City, Iowa 52242, telephone (319)338-1575, department or a designee of the department, or as otherwise directed by the department,~~as follows:

*a.* Within 30 days of completion of any water well used as part of a public water supply, a well used for withdrawal of water for which a permit is required by rule 567—50.1(455B), or wells used to monitor groundwater quantity or quality required by the department, ~~if so directed by the Iowa geological survey (IGS), department of natural resources.~~ The certified well contractor must submit the drilling records and cutting samples required by subrules 82.12(2), ~~and 82.12(3), and 82.12(4).~~



b. Within 30 days of the completion of any water well used as part of a nonpublic water supply or other water wells used to access groundwater. The certified well contractor must submit the drilling records ~~and samples~~ required by subrules 82.12(2), ~~and 82.12(3)~~, and cutting samples when required by the department as stated in 82.12(4).

c. Within 30 days of the completion of GHEX loop boreholes. The certified well contractor must submit the drilling records required by subrules 567—48.7(1), 48.7(3), 82.12(2), 82.12(3) and cutting samples when required by the department as stated in 82.12(4).

~~e.~~ d. Prior to constructing a water well to be used as part of a nonpublic water supply, GHEX loop borehole, or other water well used to access groundwater, the certified well contractor must contact the local health department in the county in which the water well is to be located or the department to determine if submittal of drill cutting samples is required.

**ITEM 34.** Amend subrule **82.12(2)** as follows:

**82.12(2)** *Drilling records.* Drilling records must be submitted on the ~~appropriate water well~~ driller's log form(s) provided by the department, or on forms that have been approved by the Iowa geological survey, department of natural resources.

**ITEM 35.** Amend subrule **82.12(3)** as follows:

a. Location and legal description (quarter section, section number, township, range and county) or by global positioning system (GPS) in the degree decimal degree format (ddd.dddd) to four decimal accuracy.

b. Diagram of well or GHEX borehole field placement on property.

~~b.~~ c. Reference point for all depth measurements.

~~e.~~ d. Depth at which each significant change of formation occurs.

~~d.~~ e. Depth at which pump is set, the nonpumping and pumping water levels in the well measured from the land surface, and the rate and duration the well was pumped.

~~e.~~ f. Identification of the material of which each significant stratum is composed.

~~f.~~ g. Depth at which hole diameters (bit sizes) change.

~~g.~~ h. Normal hole diameter of the well bore.

~~h.~~ i. Total depth of the completed hole.

~~i.~~ j. Depth or location of any lost drilling fluids, drilling materials, or tools.

~~j.~~ k. Casing depth, grouting schedule, including materials used and method of placement, and description of the well casing and liner pipe or if a GHEX borehole system, the log details required in 567—48.7(1) and 48.7(3).

~~k.~~ l. Description of well screens including diameter, length, material slot sizes, amount of open area, and location in well.

~~l.~~ m. Description of physical and chemical well development activities.

n. Any additional information compiled as a result of increased department oversight as noted in 567—48.4(455B), 48.7(1) and 48.8(1).

**ITEM 36.** Amend subrule **82.12(4)** as follows:

**82.12(4) *Cutting samples.*** Drill cutting samples shall be collected at intervals of 5 feet and at each pronounced change in geological formation. The department or a designee of the Iowa geological survey, department of natural resources, will provide drill cutting bags.

**ITEM 37.** Amend paragraph **82.13(1)“h”** as follows:

*h.* Knowingly causing or allowing a hazardous or potentially hazardous condition due to well construction services or GHEX loop borehole construction.

**ITEM 38.** Amend paragraph **82.13(1)“i”** as follows:

*i.* ~~Drilling~~ Well drilling, GHEX borehole drilling, or reconstructing a well reconstruction without first obtaining a well construction permit.

**ITEM 39.** Adopt the following **new** paragraph **82.13(2)“e”**:

*e. Elimination of hazard.* Elimination of any hazard created during well services or GHEX borehole construction.

**ITEM 40.** Adopt the following **new** **567—Chapter 48, Ground Heat Exchanger (GHEX) Loop Borehole Systems.**

## CHAPTER 48 GROUND HEAT EXCHANGER (GHEX) LOOP BOREHOLE SYSTEMS

**567—48.1(455B) Purpose.** The purpose of this chapter is to protect the public health by protecting groundwater supplies from contamination by establishing uniform minimum standards and methods for GHEX borehole installations (also known as ground-coupled, closed-loop, heat exchange borehole installations or geothermal loop boreholes.)

**567—48.2(455B) Definitions.**

“Abandoned closed-loop heat exchanger” means a GHEX loop which no longer circulates heat exchange fluid or which can no longer be used for its intended purpose.

“Abandoned well” means a water well which is no longer in use or which is in such a state of disrepair that continued use for the purpose of accessing groundwater is unsafe or impracticable.

“Administrative authority” means the county board of health or the county board of health’s designee.

“Anaerobic lagoon” means an impoundment, the primary function of which is to store and stabilize organic wastes. The impoundment is designed to receive wastes on a regular basis, and the design waste loading rates are such that the predominant biological activity in the impoundment will be anaerobic. An anaerobic lagoon does not include:

1. A runoff control basin which collects and stores only precipitation-induced runoff from an open feedlot feeding operation;
2. A waste slurry storage basin which receives waste discharges from confinement feeding operations and which is designed for complete removal of accumulated wastes from the basin at least semiannually; or
3. Any anaerobic treatment system which includes collection and treatment facilities for all offgases.

“Annular space” means the open space between the borehole excavation and the well casing or the borehole heat exchanger.

“Backflow prevention device” means an approved device or method or type of construction used to prevent backflow of water, liquids, mixtures, or substances into a well or into the distribution pipes of a potable supply of water from any source other than its intended source.

“Cesspool” means a covered excavation, lined or unlined, into which wastes from toilets or urinals are discharged for disposal. Cesspools are not an approved method of sewage disposal.

“Closed loop” means that the recirculated, heat-exchange fluid is contained within the piping in order to exchange heat, not water, with the ground. The heat-exchange fluid may or may not be exposed to the atmosphere.

“Commercial GHEX Loop Borehole System” means a GHEX loop borehole system that connects to any commercial structure as part of a heating and/or cooling system or any GHEX heating and/or cooling system that utilizes the services of a design engineer to plan and/or specify the system.

“Department” means the Iowa Department of Natural Resources.

“Earthen manure storage basin” means an earthen cavity, either covered or uncovered, which, on a regular basis, receives waste discharges from a confinement feeding operation if accumulated wastes from the basin are completely removed at least once each year.

“Flowing borehole” means a borehole that discharges groundwater at or above the land surface without the benefit of a pump.

“Formed manure storage structure” means a structure, either covered or uncovered, used to store manure from a confinement feeding operation, which has walls and a floor constructed of concrete, concrete block, wood, steel, or similar materials. Similar materials may include, but are not limited to, plastic, rubber, fiberglass, or other synthetic materials. Materials used in a formed manure storage structure shall have the structural integrity to withstand expected internal and external load pressures.

“GHEX” means ground heat exchange.

“*GHEX loop borehole*” means ground heat exchange loop borehole(s) or ground-

coupled, closed-loop, heat exchange borehole(s) or geothermal boreholes, or heat pump loop boreholes, or any excavation greater than 20 feet in depth that is drilled, cored, driven, dug, bored, augered, jetted, washed or is otherwise constructed into which a closed loop heat exchanger is installed and used as part of a ground heat exchange system.

“GHEX systems” means the various components of the ground heat exchange systems including the borehole, piping, grout, and heat-exchange fluid.

“GHEX borehole construction” means the excavation of the borehole, emplacement of the closed loop, grouting of the loop, and installation of the heat exchange fluid.

“GHEX borehole driller” means well contractor who is certified by the department to install GHEX borehole systems.

“GHEX Grout” means a National Sanitation Foundation (NSF) approved natural bentonite based material engineered, designed and produced to be used as grout for geothermal heat exchange borehole or water well installations and used to seal the annular space between the GHEX closed loop piping and the borehole. All grout shall be mixed according to manufacturer’s directions and shall achieve a permeability of  $10^{-7}$  cm/sec or less. Grout can also be neat cement based with no more than 6 gallons of water per 94 pound sack of Portland cement and no more than 6 percent bentonite calculated by dry weight. Grout density when placed into the borehole must be heavier than the drilling and borehole fluids. Drilling chips, drilling mud or heavy drilling fluids are not grout.

“Heavy drilling fluid” means water used for drilling which because of the natural clay content of the borehole or by addition of bentonite has a solids density of at least 10 percent by weight or a mud weight of at least 9.25 lb/gal.

“Heat transfer fluids” are the department approved solutions that are used inside the piping installed in GHEX systems which are used to exchange the heat with the earth.

“Local administrative authority” means the local board of health or its designee authorized to issue GHEX construction permits pursuant to this chapter.

“Low permeability material” means a geological unit of unconsolidated material (usually clay or till) or bedrock (usually shale) that is all or partially saturated, and having permeability low enough ( $10^{-7}$  cm/sec) to give water in the aquifer artesian head.

“Nonpublic water supply well” means a water supply well which is not used as part of a public water supply system. Also known as a “private water supply well.”

“Open feedlot” means an unroofed or partially roofed animal feeding operation in which no crop, vegetation, or forage growth or residue cover is maintained during the period that animals are confined in the operation.

“Open loop” means a heat-exchange system that does not utilize closed loop heat exchangers placed within boreholes in the ground or contains the heat-transfer fluid in a closed loop. Open loop systems pump water from a water source and then discharge it.

“Public water supply” means a system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. The term includes (1) any collection, treatment, storage, and distribution facilities under control of the supplier of water and used primarily in connection with the system; and (2) any collection (including wells) or pretreatment storage facilities not under the control of the supplier which are used primarily in connection with the system.

“Runoff control basin” means an impoundment designed and operated to collect and store runoff from an open feedlot.

“Well” means any excavation that is drilled, cored, driven, dug, bored, augered, jetted, washed or is otherwise constructed for the purpose of exploring for groundwater, monitoring groundwater, extracting water from or injecting water into the aquifer. The term “well” does not include an open ditch, drain tiles, an excavation made for obtaining or prospecting for oil, natural gas, minerals, or products mined or quarried, nor temporary dewatering wells such as those used during the construction of subsurface facilities only for the duration of the construction. For the purposes of this chapter, the term “well” does not include horizontal or lateral heat exchange systems less than 20 feet deep,

“Well plugging” means the closure of an abandoned well with plugging materials by procedures which will permanently seal the well from contamination by surface drainage and permanently seal off the well from contamination into an aquifer. “Well plugging” includes the proper application of filling and sealing material.

**567—48.3(455B) Applicability.** The provisions contained herein apply to all GHEX loop boreholes constructed 20 feet or greater in depth for the purpose of utilizing the heat-exchange properties of the ground or groundwater. They shall also apply to both residential and commercial installations. These rules do not apply to surface water GHEX systems, trench GHEX installations less than 20 feet in depth, or other types of GHEX installations less than 20 feet deep. All GHEX pump and discharge well systems, GHEX pump and re-inject well systems, GHEX standing column heat-exchange well systems or any other installations that meet



the definition of “well” but are not GHEX loop boreholes, are regulated by the construction rules found in 567—Chapter 49.

**48.3(1) Nonconforming GHEX installations.** Any GHEX loop borehole systems which is not constructed in a manner that complies with all of the provisions within this chapter are nonconforming systems. Any nonconforming GHEX loop borehole system feature that does not meet the requirements of this chapter and creates a groundwater hazard shall be modified at the time the nonconforming feature is found or the installation shall be properly abandoned as required in this chapter or 567—Chapter 39.

**567—48.4(455B) General.** The administrative authority shall have the authority to visit GHEX loop borehole construction sites during any phase of the construction without prior notice. The administrative authority shall by rule require the issuance of state and county well construction permits and the submission of GHEX borehole geologic logs. No GHEX loop borehole shall be initiated until the state and all required local well construction permits have been issued by the administrative authorities complying with IAC 567—Chapter 38. All GHEX loop borehole construction shall be performed by a certified as GHEX borehole driller as required in IAC 567—Chapter 82. The administrative authority may also require increased environmental site assessment, posting of performance bonds and collection and submission of drill cutting samples, grout consumption, hydro-geological data, and other pertinent information regarding the proposed or actual installation. It shall be the responsibility of the certified GHEX borehole driller to ensure that all state and local GHEX loop borehole construction permits have been issued prior to any GHEX loop borehole drilling. It shall also be the responsibility of the land

owner and the certified GHEX borehole driller to ensure that all GHEX loop borehole construction is performed in accordance with the provisions of this chapter.

**567—48.5(455B) Variances.** Variances from the construction standards found in these rules can only be issued by the department. Any permittee who requests a variance must follow the guidelines as found in 567—Chapter 10 and submit the request and support documentation in written form to the department. The support documentation must include detailed information regarding the proposed additional standards or protections that will be used during the installation of the GHEX loop boreholes that will provide groundwater and aquifer protection equal to or greater than the rules provide as written. The department will provide a written document to the permittee with information regarding variance approval or rejection. The conditions set by any variance request and any variance approval shall be provided to the land owner and noted on the GHEX loop borehole construction permit as issued on the department's Private Well Tracking System (PWTS.)

**567—48.6(455B) Location of GHEX boreholes.** The GHEX borehole driller shall consult the administrative authority for assistance in determining a proper setback distance in such cases where potential hazards to groundwater are not listed in Table 48.6(1)"a" or Table 48.6(1)"b."

**48.6(1) Minimum distances.** Any GHEX borehole with properly placed full-length grout should not be an avenue for contaminant migration. The borehole, therefore, can be placed reasonably close to other structures. Some native, undisturbed material should remain between the GHEX borehole and any other existing or future structure. The following minimum lateral distances shall apply:

Table 48.6(1)"a" Minimum lateral separation distances for vertical GHEX boreholes

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Public water supply wells defined as "shallow well" .....	400 feet
Public water supply wells defined as "deep well" .....	200 feet
Sanitary landfills .....	1000 feet
Earthen manure storage basins; livestock runoff control basins; anaerobic lagoons .....	400 feet
Domestic wastewater lagoons.....	200 feet
Industrial wastewater lagoons and basins.....	200 feet
Non-conforming private water well completed in an aquifer that will be intersected by the GHEX borehole .....	100 feet
Non-conforming private water well that is completed in an aquifer that will not be intersected by the GHEX borehole.....	50 feet
Conforming private water well completed in an aquifer that will be intersected by the GHEX borehole.....	100 feet
Conforming private water well that is completed in an aquifer that will not be intersected by the GHEX borehole .....	50 feet
Preparation or storage area for spray materials, commercial fertilizers or chemicals that may result in groundwater contamination.....	100 feet
Formed manure storage structures; confinement buildings; feedlot settling facilities; open feedlots; soil absorption fields; any sewage treatment system with an open discharge; pit privy or septic tank discharge line; sewers under pressure.....	100 feet
Septic tank, concrete vault privy, sewer of tightly joined material, or sewer-connected foundation drain.....	50 feet
Above ground liquid hydrocarbon storage tanks.....	50 feet
Below ground liquid hydrocarbon storage tanks.....	100 feet
Road ditches, right-of-ways.....	10 feet

Streams, ponds, or lakes .....	25 feet
Sewer of cast iron with leaded or mechanical joints; sewer of plastic pipe with glued or compression joints; storm sewer or independent clear water drains with water tight joints; cisterns; well pits; hydrants; frost pits; sewer collector pits and lift stations.....	10 feet
Property lines (unless a mutual easement is signed and recorded by both parties).....	4 feet

Table 48.6(1)“b” Minimum VERTICAL separation distances for  
HORIZONTAL and DIRECTIONAL bored GHEX boreholes

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All horizontal and directionally bored GHEX loop heat exchangers 20 feet or greater in depth shall have the heat exchanger piping meet or exceed the following separation distances based on vertical clearance between the heat exchange piping and the structure noted below:

Homes, basements, garages, foundations and other buildings or structures that do not pose a contamination threat to the groundwater.....6 feet

Commercial buildings, buildings warehousing potentially hazardous substances, old or new industrial sites, or areas where past or present land use activities may have contaminated the soils – Please consult with the department before drilling to establish an appropriate separation distance.

Animal confinement buildings; open feedlots; preparation or storage area for spray materials, commercial fertilizers or chemicals that may result in groundwater contamination; buried liquid hydrocarbon storage tanks.....35 feet

Private soil absorption fields; any sewage treatment system with an open discharge; pit privy or septic tank discharge line, storm water drain line.....10 feet

Septic tank, concrete vault privy; sewer of tightly joined material; sewer-connected foundation drain; sewers under pressure; liquid hydrocarbon storage.....10 feet

Earthen manure storage basins; livestock runoff control basins; anaerobic lagoons; domestic wastewater lagoons; industrial wastewater lagoons or basins – Please consult with the department before drilling to establish the correct separation distance.

**48.6(2) Response to contamination.** The GHEX borehole driller shall contact the department to determine if the borehole construction will impact known areas of contamination. The department maintains the right to modify the construction requirements or separation distances for the loop boreholes, stop the construction until the additional information is collected, or rescind the construction permit based upon actual site conditions found at the time of GHEX borehole installation.

**48.6(3) Easements.** GHEX boreholes shall not be located on property that is not owned by the GHEX system owner unless an easement allowing such placement is agreed upon by the affected property owner(s), reviewed and approved by the local permitting authority and the easement is legally recorded for all affected properties in the county where the boreholes are located.

**567—48.7(455B) General construction requirements.** To minimize the potential for contamination of the groundwater, all GHEX borehole(s) shall be planned and constructed to adapt to the geologic conditions of the proposed borehole site to maximize the protections available and utilized during the borehole construction project.

**48.7(1) Requirements for Commercial GHEX Systems.** This section applies only to any GHEX system that meets the definition of a Commercial GHEX Loop Borehole System.

a. Commercial systems shall follow all of the requirements of this chapter in addition to the following requirements:

(1) A pre-construction well site environmental audit completed and submitted to the department and local administrative authority. It will be the responsibility of the property owner,

an agent identified by the property owner, or the design engineer to conduct the audit. The audit shall include, at a minimum:

(2) Information on all known sources of contamination within 1,000 feet of the borehole field site – both historic and active – and include plume maps, monitoring well locations and contaminant testing results.

(3) Information on all known private water supply wells and public water supply wells within 1000 feet of the borehole field location. The information regarding public water supply wells shall also include the well's source water protection capture zones.

(4) A geologic review that documents existing records nearby the proposed borehole site for the following information: depth to bedrock, potential aquifers and subsurface geologic features like groundwater, fractures, voids, subsurface mines, anomalies, underground utilities and infrastructure and any other information that may indicate potential difficulty in successfully completing the borehole field and/or which may reduce long term protections for the groundwater and aquifers.

(5) A proposed loop field design that takes into consideration all of information obtained by 48.7(1) and maximizes long term groundwater and aquifer protection.

(6) Submittal of all information to the department and the local well permitting authority(ies) for review.

b. When the borehole field location passes the initial review, the local permitting authority may issue a GHEX well construction permit to construct test boreholes at the location. There shall be an adequate number of test boreholes constructed to provide the geologic information needed to understand the applicable standards required for construction that maximizes groundwater and aquifer protection. The boreholes shall be used to determine the

geologic and hydro-geologic characteristics underlying the site; such as and not limited to the depth and thickness of till, bedrock and any water bearing formations. Each borehole shall include, at a minimum:

(1) Collection of well cutting samples by the GHEX driller for each test borehole installed. Each individual sample shall be properly bagged, labeled and logged every 5 feet for future reference. The samples shall be managed in a manner that protects the samples from theft and vandalism. All samples shall be submitted to the department for review.

(2) A detailed well log for each test borehole following the requirements found in 48.7(3). All well logs shall be submitted to the land owner, the local permitting authority and the department.

(3) If a GHEX loop is inserted into the borehole, grouting standards apply as required in 48.7(7).

(4) If a GHEX loop is not inserted into the borehole, well plugging standards apply as required in 567—Chapter 39.

c. All information collected during the test borehole process shall be used by the design engineer to detail the drilling specification and products required to construct a borehole field that maximizes long-term groundwater protection.

(1) The bid specifications and documentation provided to potential bidders shall include all pre-drilling site survey information, all test borehole logs and any other additional information collected during the site survey and test drilling process that is required to successfully construct a borehole field that meets the requirements of this chapter and maximizes long-term groundwater and aquifer protections. The specifications shall also include detail on how the GHEX borehole driller and the design engineer will communicate with the department

to discuss geological, drilling and grouting problems that have the potential to increase the risk to groundwater and aquifers.

d. The bid documents shall include per unit cost for grout materials, fill materials, casing and labor needed to successfully grout each borehole. These figures shall be used for both the initial grouting and any subsequent grouting required to replace borehole grout lost due to subsidence.

e. A copy of the final “as-built” borehole locations and header pipe placement drawing shall be submitted to the property owner, the local permitting authority and the department within 30 days of connection of the heat exchange loop piping to the header piping.

**48.7(2)** Residential system pre-drilling water well survey. It will be the responsibility of the property owner, or an agent identified by the property owner, to conduct a pre-construction water well survey and apply for a GHEX borehole construction permit. The pre-construction water well survey shall identify, list, and plot, on a topographic map or aerial photograph, all known private water wells within a 250-foot radius and all known public water supply wells within a 400-foot radius of the proposed GHEX construction site property boundaries. This survey is used to find and locate actual wells, or receptors, to the uppermost aquifers, particularly those wells completed in one or more of the same zones as the proposed GHEX borehole. The applicant shall submit the pre-construction water well survey and the GHEX borehole permit application to the local permitting authority or the department in order to document minimum separation distances between water wells and the GHEX boreholes.

**48.7(3)** Heat exchanger borehole logs.



a. The applicant shall also submit to the regulatory authority and the department the well log for the first vertical GHEX borehole, or exploration borehole, and the logs for all horizontal/directional boreholes for each site unless otherwise directed by the department.

b. The log information shall include the depth and thickness of each geological formation encountered, the approximate flow of any groundwater encountered or zones of lost circulation or lost cutting returns, the depth and thickness of any fractures, voids and subsurface mines encountered, including the type of fill contained within the feature if present, information about the loop and header pipe products used including the manufacturer's name, the pipe diameter, pipe DR and the length of the loop and header pipe(s), the type of pipe end weight used on the heat exchanger, the type and brand of borehole grout used, the quantity of grout used in each borehole, the amount of grout lost in any given borehole (subsidence), the grout required to top off each borehole, and any additional information that the GHEX driller deems as important to prove due-diligence for the required record.

c. The well logs shall include an "as-built" drawing that clearly shows nearby buildings or other structures, placement of all successful heat exchanger boreholes, any abandoned boreholes, and all header piping as positioned during the actual installation.

d. All well logs shall be submitted to the land owner, the local permitting authority and the department within 30 days of connection of the heat exchanger loop piping to the header piping.

e. Additional wells logs for boreholes may be required if there is a significant change in the geological formations or if geological conditions exist that may result in long term grout failure and/or groundwater contamination. Examples of significant changes include intersecting

voids, fractures, significant or complete loss of drill fluid or drill cutting returns and aquifers that yield greater than 20 gallons per minute. Please contact the department for additional guidance.

f. The department may require additional borehole log information and the collection and submittal of borehole cuttings when the proposed GHEX loop borehole field is located in any area that may have geological features which can affect long term borehole and groundwater protections. These features include, but are not limited to, areas of karst terrain, fractures, voids caverns and subsurface mines, drinking water and non-drinking water aquifers and potential sources of contamination. This information shall include all of the normal well log information and also include: detailed information on the production of water or loss of drill fluid or drill cutting returns during borehole construction, depths at which all fractures, voids, caverns and other significant geologic features occur, any contamination observed during the drilling process, static water level of any groundwater encountered upon the completion of drilling and prior to grouting, detailed information on each loop heat exchanger that does not easily and fully enter the borehole, detailed borehole backfilling and grouting information for all boreholes including the actual amount of grout material and sand or other thermal enhancer utilized and consumed by the borehole construction, and any other information required to establish proof of long term groundwater protections and successful loop borehole heat exchanger installation.

g. All information obtained or developed to fulfill the well log requirements of this chapter shall also be provided as addendums for any specification developed for GHEX borehole drilling when the borehole project is for a system defined as a commercial system, designed by an engineer and the project awarded through competitive bidding.

**48.7(4)** Water used in construction. All water used in the construction of GHEX loop boreholes shall be obtained from a potable water source. Water used for rotary drilling fluid

shall be treated with sodium hypochlorite or calcium hypochlorite to produce an equivalent concentration of chlorine residual of 50 mg/L.

**48.7(5) Closed loop installation.** Closed loops shall be installed in the GHEX borehole immediately after drilling. All GHEX closed loop boreholes shall be grouted as soon as possible after loop installation but no later than 24 hours of borehole completion. The annular space between the GHEX piping and the borehole must be full-depth grouted using a tremie pipe and pumped pressure method of application from the bottom of the borehole upwards using an approved grout as required in 48.7(7). All confining layers that separate major or minor bedrock aquifers shall be subject to additional requirements as defined in subrule 48.8(7).

**48.7(6) Temporary borehole protection.** Any borehole that is not immediately completed and grouted to the land surface shall be covered with an appropriate device to protect the borehole from surface water, contaminants and foreign objects entering the borehole and the groundwater.

**48.7(7) Borehole grouting.** All GHEX loop boreholes must be fully grouted from the bottom of the borehole upwards in one continuous motion with the exception of those boreholes detailed in subrule 48.7(1) where the grouting must be done according to an approved standard developed by the installation of test holes, and subrule 48.8(4) when the grouting procedure must allow for filling of subsurface fractures, caverns, or caves. The amount of grout consumed by each borehole during the initial fill and any replacement grout used due to subsidence shall be recorded and submitted as part of the required well log.

a. Drilling mud or drill cuttings cannot be used as grout.

b. All bentonite based grouts shall be bentonite grouts that consist of NSF-approved natural bentonite material designed and labeled as a grout for GHEX or water well use, or neat

cement. All grout shall be mixed and placed to achieve a set grout permeability of  $10^{-7}$  cm/sec or less. Grout must be heavier than the drilling mud to minimize the risk of grout channeling. Where natural groundwater chemistry has a total hardness greater than or equal to 500 ppm and/or a chloride content of greater than or equal to 1500 ppm, bentonite-based grouts may not be appropriate; in these situations un-beneficiated sodium bentonite with cement can be used as long as the cement-based grout shall achieves a set grout permeability of  $10^{-7}$  cm/sec or less.

(1) Thermally-enhanced grouts. Thermally-enhanced grouts must be mixed to manufacturer's published specifications to achieve permeability of  $10^{-7}$  cm/sec or less and to achieve uniform mixture of any sand or approved additives. The department may approve other grouts which have a low permeability ( $10^{-7}$  cm/sec). Grout materials that contain constituents other than bentonite, sand and cement are deemed experimental under these rules. Experimental borehole grouts can only be used if proven through testing to be non-toxic and are approved by the department in writing before use in GHEX borehole installations.

(2) Cementaceous grouts. Neat cement and sand cement grouts may be used as long as they are appropriately mixed to industry standard ratios and are placed using full depth pressure grouting through a tremie pipe.

(3) Grout additives. All grout additives must be proven through testing to be non-toxic in the quantities required to achieve the benefit and approved by the department in writing before being used as part of a grout mixture for GHEX borehole installations.

(4) Grout subsidence. All grout subsidence must be replaced with equivalent grout material. Subsidence includes all settling found before the upper terminus of the GHEX loop boreholes are excavated and all settling found at the time the ground loops are connected to the

header pipes. Anytime a loop is excavated, grout material that meets the requirements of this chapter shall be added until the grout is level with the trench floor.

c. Weights. Weights, ballast, and attachments used to facilitate the emplacement of the closed loop, hardware, and appurtenances which will remain in the borehole must be composed of materials that could be approved for use in water well construction. Lead weights, ballast, or hardware are prohibited.

d. Identification of boreholes. Each GHEX borehole shall be permanently identified and located to within three feet by a means or method approved by the department and the method of identification and borehole placement clearly documented on the borehole log form. Approved methods include magnetic tape, magnetic wire, survey pins, high resolution GPS, or other methods approved by the department which will allow the buried GHEX borehole to be remotely detectable, or the borehole field(s) shall have the final borehole perimeter(s) identified by high resolution GPS and the locations clearly recorded on borehole log form(s).

**48.7(8)** Vertical and horizontal heat exchanger piping. The vertical and horizontal piping installed in a GHEX borehole shall conform to the following:

a. Piping used must be high-density polyethylene manufactured from new, non-recycled high-density polyethylene (HDPE), meet the specifications and material designation of PE 3408 or greater and be manufactured for use in “GHEX” or “geothermal” or “ground source heat pump” applications.

b. The heat exchanger pipe shall have:

(1) Factory-fused U-bend, and

(2) A Dimension Ratio (DR) of 11 having a working pressure rated for at least 160 psi or a DR of 9 having a working pressure rated for at least 200 psi.

(3) Field connections, field repairs and pipe modifications shall follow manufacturers' written instructions for application, testing, protection and use, and be performed by individuals who have completed the pipe manufacturers training for product handling and fusion methods.

c. Any pipe installed within the GHEX borehole shall have the upper terminus open pipe ends sealed to prevent dirt and debris from entering the pipe. Approved methods include pipe plugs and heat sealing pipe ends through crimping or by coupling the pipe ends via heat fusion method. Under no circumstances shall pipe be sealed using only tape products.

**48.7(9)** Outdoor horizontal header and connector piping. The horizontal piping installed for use in GHEX system shall conform to the following horizontal piping standard:

a. Horizontal piping must be high-density polyethylene manufactured from new, non-recycled high-density polyethylene (HDPE), meet the specifications and material designation of PE 3408 or greater and be manufactured for use in "GHEX or geothermal or ground source heat pump" applications.

b. Pipe diameters of 2 inch and less must have a Dimension Ratio (DR) of 11 having a working pressure rated for at least 160 psi or a DR of 9 having a working pressure rated for at least 200 psi.

c. Pipe diameters of greater than 2 inches must have a Dimension Ratio (DR) of 15.5 having a working pressure rated for at least 110 psi, or a DR of 11 having a working pressure rated for at least 160 psi or a DR of 9 having a working pressure rated for at least 200 psi.

d. Buried field connections, connection repairs and piping modifications of horizontal subsurface pipe shall be heat fused by butt, socket, sidewall or electro-fusion methods in accordance with the pipe and pipe fitting manufacturer's procedures and standards, and be performed by individuals who have completed the pipe manufacturers training for product

handling and fusion methods. Stab fittings or other types of mechanical connections may only be used if the subsurface location is accessible as in interior vault connections.

e. Any pipe installed and not immediately connected to other system piping shall have the piping ends sealed to prevent dirt and debris from entering the pipe. Approved methods include pipe plugs and heat sealing through crimping. Under no circumstances shall pipe be sealed using only tape products.

**48.7(10) Fittings.** The material used in the manufacture of the fittings shall be the same base resin material as the connecting closed loop pipe. Closed loop pipe fittings buried below grade shall be molded and manufactured to the specifications and requirements of American Society for Testing and Materials (ASTM) D-2683 for socket fittings, ASTM D-3261 for butt-welded fittings, ASTM F-1055 for electrofusion fittings. Mechanical and barbed fittings shall not be used buried below grade unless within a vault or other accessible location, unless approval in writing by the department.

**48.7(11) Joints.** Joints for the pipe and fittings shall be heat fusion or electrofusion fittings. Heat fusion joints shall be assembled in accordance with the manufacturer's recommended fusion-joining procedures performed by individuals who have been certified in the fusion joining procedures. Electro fusion and mechanical joints shall be assembled in accordance with the fittings' manufacturer's instructions and be performed by individuals who have completed the pipe manufacturers training for product handling and fusion methods.

**48.7(12) Pressure testing.** Only leak-free piping may be placed in operation within the borehole and horizontal piping installation. For closed loop piping, the pressure-test shall be completed before the loop is installed into a GHEX borehole. For horizontal header piping, the pressure test shall be completed before the horizontal trench is backfilled. The testing shall be

completed using compressed air or potable water using a pressure of 75 psi or 1.5 times the system operating pressure, whichever is greater, for a minimum of 30 minutes. The pressure test shall demonstrate that there is no leakage. If leakage occurs, all leaks must be properly repaired. After the GHEX heat exchanger and piping system has been completed and connected together, all system piping must be pressure-tested with air or potable water for 30 minutes minimum using a pressure of 75 psi or 1.5 times the system operating pressure, whichever is greater. If a pressure change indicates that the system has a leak, the leak shall be found and repaired before the system is placed in operation.

**48.7(13)** Trench pipe bedding. Horizontal piping shall include firm, stable, uniform bedding placed under the pipe for continuous support. The pipe bedding shall ensure that the pipe will not be damaged by trench backfill operations, by trench settling, or by system operation.

a. Where rock is encountered in trenching, it shall be removed to a depth of not less than 6 inches below the bottom of the pipe and bedding shall be added as required under 48.7(13)“b.” The pipe shall not rest on rock at any point, including joints.

b. Where trenches are excavated to depths below the bottom of the pipe, bedding shall be added beneath the pipe as required. Such bedding shall be of clean sand, gravel, or similar select material that is compacted sufficiently to provide the support required.

c. When the piping is placed in the trench, care shall be used to ensure that the trench bottom is smooth and free from sharp or angular objects. Care shall be used when transitioning piping through a bend or corner to ensure that the pipe does not fold or kink. In corners where the trench sidewall will come in contact with the piping, the sidewall shall be contoured to allow a smooth, supported radius for the pipe.



d. The Initial backfill shall embed the pipe with a minimum of four-inches on each side and include a minimum of four-inch cover, and shall be clean native granular materials.

Embedment soils must be free from refuse, organic material, cobble, boulders, large rocks or stones, and frozen clods that may damage the structural integrity of the pipe or the connections. Flowable fill materials may be used as long as the material(s) meet the requirements of this rule.

e. An insulated copper tracer wire or other approved tracer product or conductor shall be installed adjacent to all subsurface horizontal GHEX piping to facilitate discovery of the buried piping. One end shall be brought above ground inside or outside the building or vault wall. The tracer wire shall not be less than 18 AWG insulated. The insulation of the tracer wire shall not be yellow in color.

f. The trench shall be backfilled from the top of the compacted initial backfill to finish grade using suitable material. Compacting equipment may be used for the final backfill to minimize settling. The final fill grade shall allow for settling within the trench.

**48.7(14) Heat transfer fluids.** All heat transfer fluids used in GHEX closed loop heat exchangers must be food-grade, United States Pharmacopeia (USP) grade, or approved for incidental food contact applications by the National Sanitation Foundation (NSF.) Products specifically designed for use as geothermal heat transfer fluids that are Food and Drug Administration (FDA) labeled as “generally recognized as safe” (GRAS) may be used with written approval from the department. Additives used for the treatment of heat transfer fluids must be NSF approved for drinking water applications, FDA GRAS designated or approved in writing by the department. Additives shall be used only in concentrations recommended by the manufacturer to perform the desired treatment. A permanent sign must be attached to the heat transfer fluid injection point(s) on the heat exchange system specifying what heat transfer fluid

and additives the system currently contains and that only approved heat transfer fluids may be used in the system.

**567—48.8(455B) GHEX borehole construction criteria for difficult geological conditions.**

**48.8(1)** Installation of closed loop heat exchange boreholes in difficult geological settings. In areas of the state where contamination may be an issue and/or where geological features may exist that require additional GHEX loop field design considerations, borehole construction considerations, and/or borehole stabilization and grouting considerations, the GHEX loop boreholes shall be installed with increased oversight from the department and/or the local permitting authority. The department may require the collection of additional information on contaminated sites, local geological features, and test borehole logs and cutting samples before construction permitting is approved and the GHEX loop field production drilling can be initiated. In addition, the department may place conditions on the GHEX borehole construction including but not limited to, contaminated groundwater study, hydrogeological study, borehole field location study, limitations on maximum borehole depth, additional grouting requirements, and any other construction related enhancements necessary to ensure borehole integrity, system operation, and aquifer protections. All additional information as required by the department and all information assembled as part of 48.7(1) shall be provided as addendums for any specification developed for GHEX borehole drilling when the borehole project is for a system defined as a commercial system, designed by an engineer and the project awarded through competitive bidding. The department will make available guidance regarding known difficult geological settings. All commercial borehole fields or borehole fields designed by an engineer shall include test boreholes as required in 48.7(1) and take into consideration that borehole

conditions may require additional borehole stabilization materials, grouting products and fill products. The bidding process shall include per unit cost for fill material, grout material, casing material and any other consumable products necessary to ensure proper construction, operation of the loop borehole(s) and long term groundwater protection.

**48.8(2)** GHEX boreholes constructed in unconsolidated materials. Water-saturated, fine-grained earth materials (e.g., loess, sand, sandstone) may tend to flow during drilling and create large voids. Borehole stability will be the goal of the driller, and there may be innovative ways to accomplish stability including the use of traditional water well construction tools such as casing, liner, gravel-pack, fill, and various grouting media and methods. Techniques used to stabilize the borehole will be allowed if the stabilization technique uses clean, non-organic, native materials, bentonite or cementitious products and the products used does not allow the movement of groundwater into or out of the aquifer via the borehole.

**48.8(3)** GHEX boreholes drilled in glacial-till dominated terrains may encounter several aquifers or water-bearing zones (i.e., loess/till contact, till/bedrock contact, interbedded sand and gravel units, basal glacial drift sand and gravel units). Care shall be used in placement of the borehole grout to protect any local aquifers from any vertical movement of grout and/or groundwater.

**48.8(4)** GHEX boreholes constructed in bedrock. Numerous areas of Iowa are underlain by bedrock geology that can include highly porous zones, cavernous or fractured areas within the bedrock, or other features associated with the bedrock that cause borehole stabilization, water production, grout loss issues, and interference with existing boreholes and water wells. Extreme care must be used to ensure the stability and effectiveness of the grout materials within the borehole. Borehole stabilization techniques shall not allow the migration of stabilizing material

(especially bentonite, sand, ag-lime, or other materials that tend to “flow”) to any well.

Developing borehole stability by utilizing rock chips, sand, ag-lime, cement, bentonite, and other traditional water well construction materials is allowed. However, since individual boreholes can encounter more than one such porous zone, it is required that each porous zone be stabilized separately, and each section of borehole between the porous zones be full-length grouted to prevent groundwater from migrating along the borehole from one porous zone to another. When a borehole encounters fractures or voids that may result in grout instability and subsidence, the well driller shall follow the requirements or consult with the department for site specific requirements:

- a. Small fractures. Small fractures can be filled by using dense bentonite grout, cementitious grouts, or with chipped bentonite plugging material as long the material used will allow the borehole grout column to remain stable.

- b. Large fractures and voids. Large fractures and voids may be filled with clean fill like gravel, pea stone, limestone chips, and bentonite chips, as long as care is used to place the fill material to ensure that it does not bridge in the borehole and that the grout placed above the fractures and/or voids remains stable. Under no circumstances shall the borehole be filled entirely of clean fill material. Grout must always be placed in the areas of the borehole that do not have large fractures or voids.

- c. Areas of extreme borehole instability. In areas where the borehole is so unstable that the loop cannot be successfully placed to full depth or where the borehole will not allow the grout column to remain in place, the well driller shall utilize a well casing to stabilize the borehole. Any permanent casing must be grouted at the upper and lower contact points of the

casing to the borehole wall to eliminate any vertical pathway that allows groundwater or grout to migrate into the unstable area.

**48.8(5)** Abandonment of borehole because of instability. If a borehole cannot be utilized because of any bedrock instability, the borehole must be properly plugged as required in 48.10.

**48.8(6)** Flowing boreholes. Boreholes that encounter permeable formations which result in groundwater movement from any given zone within the borehole must be stabilized to prevent the vertical movement of groundwater. This movement can be either upward or downward and includes flowing onto the ground surface. The type of grout used, the density of the grout prepared, and the method used for grout placement shall ensure that the grout will confine each zone and not wash away by groundwater under pressure. Under no circumstances shall a borehole be allowed to openly flow once construction is completed.

**48.8(7)** Interconnection of aquifers. GHEX boreholes shall not penetrate a confining unit which separates major bedrock aquifers. When a major bedrock aquifer is utilized, the confining layer below must not be penetrated. The following major bedrock aquifers shall not be interconnected by a GHEX borehole:

Cretaceous Dakota Formation.

Mississippian System.

Silurian-Devonian Systems.

Ordovician System above the St. Peter Sandstone (Galena aquifer, Maquoketa Formation).

Cambrian-Ordovician Systems – St. Peter Sandstone through the St. Lawrence Formation (Jordan aquifer).

“Dresbach” aquifer – Galesville Member, Eau Claire Formation, and Mt. Simon Formation.

Information regarding bedrock aquifers can be found in “Iowa’s Groundwater Basics” as published by the Iowa Department of Natural Resources (Iowa Geological and Water Survey Educational Series 6), or by contacting the department.

a. Minor confining units. Confining units within and between minor bedrock aquifers must be restored to ensure the integrity of the confining unit. Proper grouting of the confining bed shall take into consideration the porosity and permeability of the bedrock aquifers and use of a grout product that will minimize the possibility of grout migration and subsidence.

b. Exploration borehole. The first exploration borehole may be drilled to any depth to determine the geologic profile, the presence of geologic features that may create problems in successfully completing loop boreholes, and the thermal conductivity of the earth materials. If the exploration borehole will be used as a GHEX borehole, any confining unit between major bedrock aquifers, which was breached by the drilling of this exploration borehole, must be sealed with grout and the grout allowed sufficient time to achieve set and stability before the installation of the heat exchange closed loop above the confining unit. The base of the GHEX loop must be at least 10 feet above the top of the confining layer. Subsequent GHEX boreholes in the same borehole field shall also terminate at least 10 feet above the top of the confining unit. The top of the confining unit is determined by the exploration borehole and any subsequent boreholes which encounter the same or equivalent geologic unit.

**567—48.9(455B) Disposal of drilling wastewater.** Drilling fluid, drilling mud, drill cuttings and drill site wastewater generated during the construction of GHEX installations shall be properly disposed of at the time of construction.

**48.9(1)** Drilling fluids or drill cuttings shall not be disposed of in a stream or storm sewer nor shall these materials be discharged into a sanitary sewer without permission of the owner and operator of the wastewater treatment facility.

**48.9(2)** All GHEX borehole construction related wastewater that reaches Waters of the United States is subject to the management requirements for well construction related wastewater found in 567—Chapter 64.4(2)“a”(3) and General Permit #6 (GP6.) GP6 requires notification to the Iowa DNR Field Services Office in the region where the construction is taking place, the development of an adequate well water pollution prevention plan (WWPPP), placement of adequate best management practices (BMPs) for wastewater treatment, periodic inspection of the BMPs, and documentation of compliance.

**48.9(3)** Reasonable care should be used so that GHEX borehole related wastewater does not create a nuisance to adjoining property owners.

**567—48.10(455B) Abandonment and plugging of GHEX boreholes.** Any borehole that will not be used as part of the active borehole field shall be properly plugged so that the abandoned boreholes do not pose a contamination hazard to nearby drinking water wells or the groundwater. Proper plugging is dependent on the individual borehole and the geological setting.

**48.10(1)** Borehole with closed loop pipe contained within the borehole. If the GHEX borehole was completed and conforming to this chapter and there are closed loop pipe(s) still within the borehole, the closed loop pipe(s) shall be disconnected from the header pipe if the

connection exists the loop pipe shall be filled with an approved grout material by pressure pumped method. The heat transfer fluids displaced by the grouting of closed loop pipes shall be contained and disposed of properly. Any grout subsidence found during loop borehole excavation shall be replaced with approved grout material.

**48.10(2)** Any GHEX borehole that does not contain closed loop pipe shall be plugged using the appropriate Class II well plugging requirements as found in 567—subrule 39.8(6).

**567—48.11(455B) GHEX system related devices.**

**48.11(1) Flow measurement device.** Any GHEX system where the manufacturer's design standards for installation require flow measurement shall have a flow measurement device placed in the system in a readily accessible and visible location.

**48.11(2) Water make-up lines.** GHEX system automatic water make-up lines are prohibited. Make-up water and heat transfer fluids shall be supplied to a system using an approved holding supply tank. The tank shall include a method of determining water or fluid level within the tank and be placed in a readily accessible and visible location. Any water make-up lines used to feed water into the tank shall be protected with a backflow prevention device that meets applicable state and local plumbing codes for the type of protections required.

**567—48.12(455B) Waste disposal prohibition.** Under no circumstances shall any GHEX test holes, boreholes, or heat exchanger installation be used for the disposal of debris, solid waste, septic tank sludge or effluents, or any other type of unauthorized disposal of waste materials, or as a receptacle for field tile drainage or other surface water sources.



**567—48.13(455B) Maintaining industry standards.** These rules shall be reviewed every 6 years to determine if revisions should be initiated to address changes in industry standards or to identify and modify areas that are deemed substandard to achieve the required groundwater protections.

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